

Sustainability in Construction

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Introduction

1.1 The Scottish Government is committed to ending Scotland's contribution to climate change. We will do this by 2045, in a fair and just way.

1.2 The Scottish Government fully supports sustainable development, the concept that the needs of the present must be met without compromising the ability of future generations to meet their own needs¹. As part of the national endeavour to achieve net zero greenhouse gas emissions by 2045, the Scottish Government's Programme for Government commits to action on the climate impact of significant annual public procurement spend². Climate change [reporting duties](#) and public [procurement policy](#) require public bodies to consider and act to reduce emissions in order to meet [greenhouse gas emissions targets](#).

1.3 The built environment is one of the biggest contributors to carbon emissions, estimated to account for nearly 25% of total UK greenhouse gas emissions. The UK Green Building Council reports that operational and embodied carbon from construction currently accounts for around 6% of the UK's annual emissions³.

1.4 As part of the [Just Transition](#) to net zero and a more resource efficient, low carbon economy, there is a need to significantly reduce associated carbon emissions from the built environment. This chapter summarises good sustainable construction practice. Links to a wide set of resources have been provided in section 11 of this chapter. These cover policy, technical guidance and good practice notes from Scottish Government, public sector bodies and industry representative bodies. The Scottish Government also intends to develop a draft Buildings and Construction Just Transition Plan by end 2023, which will build on this work and provide sector-wide clarity.

Background

2.1 This Sustainable Construction guidance embraces the three traditional pillars of sustainability, which are social, environmental and economic. Considering the three pillars simultaneously will assist public sector clients deliver outcomes that are:

- Socially sustainable – demonstrating socially responsible leadership through the delivery of healthy and inclusive outcomes
- Environmentally sustainable – actively protecting biodiversity and the environment through the adoption of a whole life approach and effective mitigation strategies
- Economically sustainable – enabling inclusive economic growth through fair and resilient practices

2.2 The term 'project' is used broadly to encompass a full range of built environment and civil engineering works through the work stages. It covers what you

¹ [Sustainability | United Nations](#)

² [Public procurement - taking account of climate and circular economy considerations: SPPN 3/2022](#)

³ [Climate change - UKGBC - UK Green Building Council](#)

need to consider as a client, project manager or consultant etc. when sustainably delivering a public sector construction project.

2.3 The guidance contained here is complementary to and aligns closely with the principles of a range of other policies and legislation which are referred to and linked throughout the guidance. A key example being the Scottish Government's [Sustainable Procurement Tools](#) which are available to all public bodies. These support the aims of the [National Performance Framework](#). The tools include indicators and guidance to support Scottish public sector buyers to consider and act on a number of climate change considerations. One such tool is the Sustainable Public Procurement Prioritisation Tool, which is designed to assist public sector clients strategically plan and prioritise their social, environmental and economic considerations.

Importance of Good Governance

3.1 Good governance and the early implementation of a [robust governance strategy](#) are crucial in delivering a sustainable construction project. This approach promotes goal setting, awareness raising and information sharing. At each life cycle stage this decision making needs to consider the identified social, environmental and economic priorities and objectives and be governed by responsible and robust practices. This approach encourages individuals to take appropriate levels of responsibility and provides assurance of sustainability.

3.2 Guidance on project governance can be found in Chapter 2 of the [Project Initiation and Business Cases Handbook of the Client Guide to Construction Projects](#). This emphasises the importance for everyone involved in a project taking individual and collective ownership and being accountable for the conduct and delivery of the project.

3.3 Sustainable procurement considerations must encompass every construction life cycle stage. However, as demonstrated in figure 1, the ability to influence sustainable outcomes is greatest right at the very start of a construction project in the planning phase. Informed, early stage decision making and adopting a collective, integrated and holistic whole life approach maximises the opportunity to deliver long-term value. This helps improve quality of delivery in a considered and sustainable way.

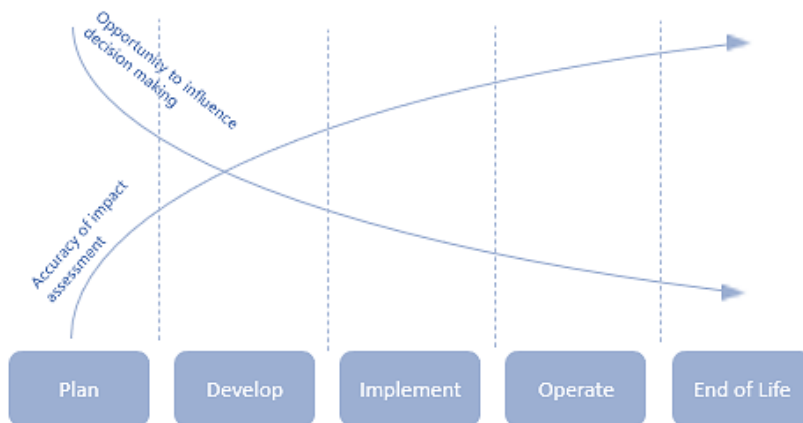


Figure 1: Construction Life Cycle Stages

3.4 The guidance follows the stages below, which relate to the construction lifecycle:

- **Planning** – identifying and responding to the end user need, informing options appraisal activity and planning for delivery
- **Development** – influencing procurement activity, informing the design development and instructing any pre-constructing activity
- **Implementation** – inform detailed design, construction and commissioning strategy
- **Operation** – responsibly manage, utilise and maintain the asset
- **Decommissioning** – plan for end of life and future re-use, repurpose and /or recycling opportunity

3.5 The development of a Sustainability Matrix can help to summarise and communicate the various needs and requirements of a project. It provides clients with a tool that assists them in reviewing and evaluating the project's sustainability credentials. We have developed a Sustainability Matrix to assist public contracting authorities and this is shown in Annex B.

Planning

4.1 The planning stage is critically important in developing all projects and this must include sustainability considerations. It requires adequate appropriate resourcing during the earliest planning stages to ensure end user needs are clearly defined and understood and fully integrated into the project brief and plan (see chapters in the Client Guide for developing a [Business Case](#) (chapter 4) and [Creating the Project Brief](#) (chapter 2).

4.2 As part of this planning stage, sustainability priorities and performance outcomes should be identified and agreed, influencing any investment decisions, option appraisal activity and providing strategic direction from the very outset.

4.3 A [Circular economy](#) approach that adopts the waste hierarchy principles and that seeks to conserve and value all resource use should inform early conceptual design and construction approaches. The Project business case should follow the Scottish Government’s Investment Hierarchy, as developed by the Infrastructure Commission for Scotland, and supported by the Scottish Government, as shown in Figure 2 below⁴:

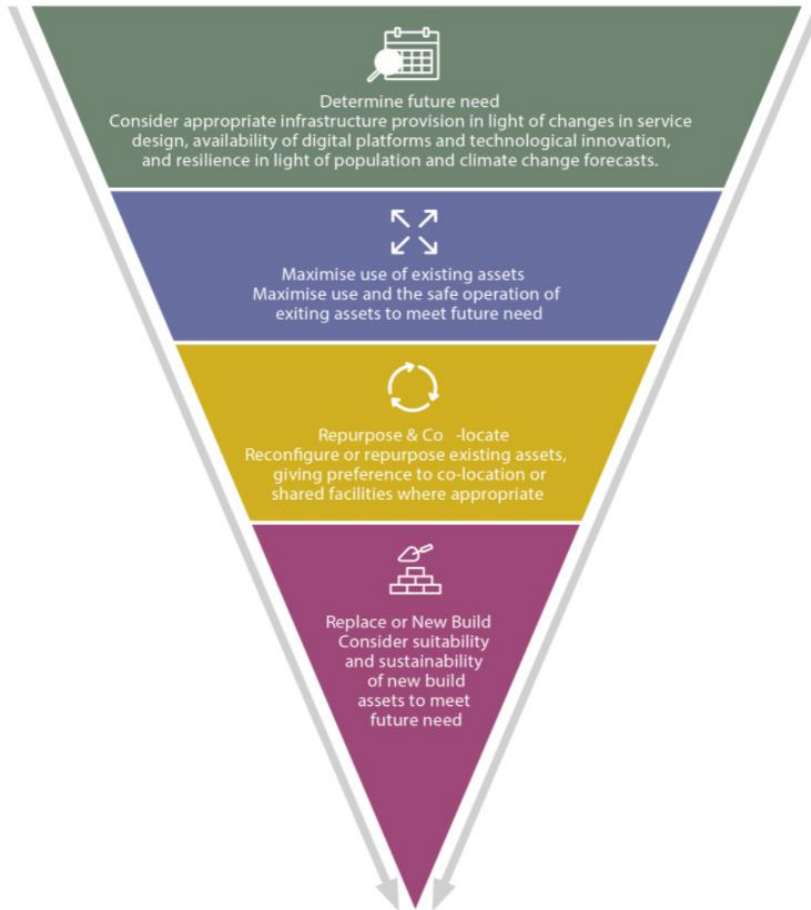


Figure 2: Scottish Government Investment Hierarchy

4.4 As described below, planning for the sustainable construction of a sustainable whole-life built assets requires consideration of many factors across social, economic, environmental and carbon fields. Key factors to consider are:

- The importance of understanding, respecting and developing relationships between **people and place** and the impact of the built asset on the place and the people. Reference should be made to guidance on [Place-based](#) approaches and consideration given to the impact of the project for inclusive growth including [Community Wealth Building](#), [Fair Work First](#) employment and the [Scottish Business Pledge](#), promoting fairness, equality, opportunity and innovation.

⁴ [A National Mission With Local Impact: Infrastructure Investment Plan for Scotland 2021-22 to 2025-26 \(www.gov.scot\)](#)

- It is estimated that people spend 90% of their time inside buildings. The **internal and external environment** therefore has a significant impact on the health and wellbeing of occupants. Projects should prioritise physical and mental wellbeing through the creation of healthy places and there are a number of standards, tools and strategies related to [Ventilation design](#) (internal air quality), [Secured by Design](#) (for safe and secure access) and Biophilic Design (incorporation of nature) that are available for those requiring technical detail.
- Projects should consider what preventative, protective and enhancement measures are required to support and enhance **environmental security** and adaptation to the irreversible impacts of climate change. This is the protection of the natural environment from the potential negative impacts of human activities such as construction works. As a minimum an environmental security strategy should be produced which would typically be expected to cover:
 - land use
 - geo-environmental risk
 - adapting to climate change and minimising greenhouse gas emissions in the construction, operation and decommissioning phases
 - biodiversity (required levels of protection and opportunity for enhancement)
 - water management
 - waste minimisation and recycling options
 - air quality
 - noise pollution
 - other nuisances and any risk from external sources of pollution
 - opportunity for optimising site layout (for buildings and people)
 - opportunity for greenspace intervention
- Projects should help to prioritise **active travel and more sustainable transport modes** by making these options more accessible, attractive and inclusive to all users. The [20 minute neighbourhood concept](#) may be helpful in recognising opportunities to bring together and address a number of socio-economic and environmental priorities. This approach may help enable people to meet most of their daily needs within a 20-minute walk from home, with safe cycling and local transport options.
- To be sustainable, it is critical that projects adopt a **whole life carbon approach**, considering both embodied and operational carbon and associated impacts at every life cycle stage. It is recommended that projects set whole life carbon targets and / or objectives referring to the [Scottish Government Net Zero Public Sector Building Standard](#) guidance for the setting of embodied and operational targets, where appropriate. This approach will encourage more responsible, efficient and circular resource use.
- [Whole Life Costing](#) should be used on projects to consider capital and operational costs. The results should be used to inform early decision making and improve design, specification, through-life maintenance and operation.

Development

5.1 Following the planning stage described above, a fully integrated and well-considered project development approach is required by the entire project team. This will ensure the project is delivered in a holistic and sustainable way. It is essential that all time, cost and quality impacts connected to the sustainability targets are allowed for at this point, prior to the implementation stage.

5.2 Sustainability assessments should be scheduled throughout the project life-cycle to allow clients to review and assess proposals in detail. A sustainability matrix such as in Annex B can be utilised for this purpose. This assessment process will enable clients to consider how well the needs of the end user and priority outcomes are being met prior to progressing to the next delivery stage. This allows for collective review and enables clients to intervene to support and encourage optimisation against all priority social, economic, environmental and carbon outcomes.

5.3 To enable the sustainable delivery and development of all projects, a programme for continued stakeholder engagement and a communication strategy (including the provision of feedback) should be in place throughout the development stage. This should continue to align with place-based principles and allow structured, consistent approach to focus on end user needs and optimised operational requirements from the outset of a project.

5.4 Early supply chain viability testing should be undertaken to consider options and maximise opportunity for specification, procurement and use of lower embodied carbon products, circular products and natural materials. Early supply chain engagement can also help to drive innovation through the supply chain. See chapter four, [Preliminary Market Consultation](#) of the Construction Procurement Handbook of the Client Guide to Construction Projects.

5.5 The use of Modern Methods of Construction, such as [Offsite construction](#), should be explored during early development stages, recognising quality and environmental benefits (for example, greater resource efficiency and less waste) that could be achieved.

5.6 To ensure accuracy and reliability of results, credible and robust life cycle assessment calculation tools, methodologies and information sources must be used.

Implementation

6.1 [Chapter 3 of the construction phase handbook](#) of the Client Guide to Construction Projects provides an overview of the client's role in achieving quality, particularly during the construction phase. It provides guidance to assist contracting authorities to successfully deliver outputs and outcomes in their construction projects which meet the requirements stated in the Project brief and business case.

6.2 A carbon mitigation strategy should be implemented to mitigate carbon emissions associated with the Construction Stage. This should consider:

- Transport of materials to site e.g. prioritisation of local sourcing and promotion of low emission vehicles
- Resource efficiency e.g. resource management plans (with industry recognised best practices waste reduction actions and targets) and diversion from landfill strategies and targets
- Energy consumption e.g. the use of 'green' energy supplies for site accommodation and reduced reliance on diesel generators for plant use (the use of diesel replacement fuels, for example, could be explored)
- Choice of materials to minimise embodied carbon impacts and consideration of the carbon impacts associated with where to source materials

6.3 A design for disassembly/deconstruction/recycling guide should be prepared in advance of handover. The guide should consider realistic and feasible project-specific scenarios for the intended / expected future handling of items beyond the end-of-life stage. It is expected that the guide will provide clients with information on the following, where relevant:

- Functional adaptation: the likelihood for the asset to support multiple or alternative uses (as informed by client / end user need)
- Exposed and reversible connections: more visible connections providing opportunities to optimise material and product reuse. Welded connections can prohibit disassembly and it is preferable to use screws and bolts to allow for disassembly and material reuse.
- Layer independence: designing systems and components in layers so that removal, adjustment or replacement of some elements is feasible, especially when different components have different life spans and maintenance needs
- Avoidance of unnecessary toxic treatments and finishes. Some finishes can contaminate the substrate in a way that they are no longer reusable or recyclable (this should be avoided unless finishes serve a specific purpose)
- Standardisation can accommodate reuse and upgrading - it involves aspects such as dimensions, components, connections and modularity.

6.4 As part of the implementation phase it is advised that the overarching principles of people and place, health and wellbeing, whole life carbon, sustainable travel, environmental security, inclusive growth and economic resilience should be adhered to. This includes:

- A programme of pre-completion inspection, commissioning and testing is allowed for, ensuring the project has successfully delivered against the agreed performance requirements.
- Principal contractors are required to ensure responsible site management procedures, processes and practices are in place and are understood and adopted by all during the construction phase. It is expected that this will include procedures that promote responsible environmental and carbon management activities and pollution prevention procedures.
- Prior to handover, project specific user guides / information are prepared including relevant management and optimisation information.

- A site-specific travel plan is prepared in an accessible format to communicate the sustainable travel aspirations of the development.
- The benefits of adopting circular design and construction practices are captured and reported including a decommissioning plan.

Operation

7.1 Once the construction stage is complete it is vital that the built asset is operated in the way it was intended to ensure the economic, social and environmental benefits are maximised. This will require a smooth and supported handover process with provision of aftercare established to support optimisation from day one and to allow for a period of fine-tuning and adjustment as required. Critically, comprehensive operation and maintenance and health and safety manuals must be completed, handed over and subsequently kept up to date.

7.2 To enable the sustainable management and operation of all projects, the following social, environmental and economic issues should be considered during the operation stages:

- A [Post Occupancy Evaluation](#) programme is necessary to determine if the facilities meets the users' requirements and function as required. This could include physical monitoring and user consultation exercises.
- A [post project review exercise](#) should take place to capture lessons learned as a result of adopting a whole life approach to carbon, and to promote wider knowledge share.
- Operating costs, including planned and reactive maintenance and replacement costs should be monitored and reported, allowing a comparison with design stage predictions and for any discrepancies to be analysed.
- A strategy for monitoring of impacts should be established with reviews used to inform continuous improvement strategies. This is likely to include carbon footprint, sustainable travel trends, review of management and maintenance strategies and the effectiveness of resilience, pollution control and environmental strategies as well as monitoring initiatives that support [Community Wealth Building](#) and inclusive growth.

7.3 The project aftercare strategy must be implemented. This will promote activities aimed at supporting optimisation during the Use stages, for example, seasonal commissioning activity that will support the fine-tuning of systems and services to enhance comfort, efficiency and sustainability, a detailed review of the facilities management strategy and the impact of operations and any alterations to the 'as constructed' status of the asset on the Carbon Management Plan.

7.4 The project should continue to adopt a whole life carbon approach during operational stages. The integrated *Life Cycling Costing* and *Life Cycle Assessment* activity should continue to support this. It should also aim to inform more responsible procurement practices. Consideration should be given to the carbon impacts of hard and soft facilities management and appropriate mitigation strategies adopted.

7.5 Annual operating costs, including planned and reactive maintenance and replacement costs and the level of functional adaptation that the project has allowed

for should be monitored and reported, allowing a comparison with design stage predictions and for any discrepancies to be analysed.

Decommissioning

8.1 The Scottish Government considers a [circular economy](#) as an essential part of the solution to the recognised global climate emergency. This approach requires materials, services and systems to be designed to maximise value and minimise waste in a cycle of disassembly and reuse. To achieve this, the building must be designed for deconstruction and it's materials capable of remanufacture and reuse. Adopting these principles will give a new life to construction materials at the end of their initial lifecycle.

8.2 In support of circular economy, the following issues should be considered during the decommissioning stages:

- A Whole Life Carbon approach will require benefits beyond the project's end of life stage to be considered and reported separately.
- Circular economy principles and practices should continue to be supported and followed with the extent of any reuse or recycling tracked and monitored.

Summary

9.1 Sustainable construction should be considered from the beginning of a project. The ability to influence sustainable outcomes is greatest right at the very start of a construction project. Informed early-stage decision making creates maximum opportunity for socio-economic and environmental impacts to be realised at every life cycle stage.

9.2 Contracting authorities should adopt a holistic whole life carbon approach when tackling sustainability issues in the design, delivery, operation and decommissioning of their construction projects.

9.3 Construction projects cannot be procured sustainably by simply looking to address singular issues in sustainability: a collective, integrated and holistic whole life approach, such as the one described in this guidance is required. All projects must prioritise those issues that are most significant to the project and identify where particular opportunities and challenges may arise.

Recommended Further Reading and Support

10.1 Below are links to recommended further reading on the topic of sustainable construction. These cover policy, guidance and good practice notes from Scottish Government, public sector bodies and industry representative bodies. This list is not exhaustive but provides direction to some of the background information available.

Scottish Government:

[Reducing greenhouse gas emissions - Climate change](#)

[Sustainable Procurement Tools \(sustainableprocurementtools.scot\)](#)

[Sustainable procurement duty - Public sector procurement - gov.scot \(www.gov.scot\)](#)

[Public procurement - taking account of climate and circular economy considerations: SPPN 3/2022 - gov.scot \(www.gov.scot\)](#)

[Fair Work First: guidance - Scottish Government](#)

[National Performance Framework - Scottish Government](#)

[Place Principle: introduction - Scottish Government](#)

[Creating Places: A policy statement on architecture and place for Scotland](#)

[Making Things Last: a circular economy strategy for Scotland](#)

[20 minute places \(partnersinplanning.scot\) - Scottish Government](#)

[Taking account of climate and circular economy considerations in public procurement - Scottish Government](#)

[Net Zero Public Sector Buildings Standard - Scottish Futures Trust](#)

[What is the National Planning Framework? | Transforming Planning - Scottish Government](#)

[Heat in Buildings Strategy - Scottish Government](#)

[Whole Life Appraisal Tool for the Built Environment - Scottish Futures Trust](#)

[National Just Transition Planning Framework – Scottish Government](#)

[The Place Principle | Our Place](#)

Other Reference Guidance:

[Climate Emergency Design Guide | LETI](#)

[LETI Embodied Carbon Primer - supplementary guidance to Climate Emergency Design Guide](#)

[Net Zero Estate Playbook - UK Government Property Function](#)

[Whole Life Carbon Assessment for the Built Environment, 1st edition \(rics.org\)](#)

[IMPACT Life Cycle Assessment Tools - BRE Group](#)

[RIBA-2030-Climate-Challenge](#)

[Renewable Energy Procurement & Carbon Offsetting Guidance for Net Zero Carbon Buildings - UKGBC - UK Green Building Council](#)

[Net Zero Whole Life Carbon Roadmap for the Built Environment - UK Green Building Council](#)

PRINCIPLES AND POLICIES IN PRACTICE - CASE STUDIES

1.0 Listed below are a series of case studies which evidence sustainable construction principles in infrastructure projects across the public sector. These have been split across various topic headings to assist in navigation to topics of interest or relevance.

Case study examples

1.1 People and place: NHS Asset Management Case Study
casestudysftplacehealthhub.pdf (scottishfuturestrust.org.uk)

1.2 Local Authority Urban Design Forum, Architecture & Design Scotland
[SERVICE: Local Authority Urban Design Forum \(LAUDF\) – A&DS \(ads.org.uk\)](#)

1.3 Health and wellbeing: NHS Forth Valley, Building with Nature
[Forth Valley Hospital detail — Building with Nature](#)

1.4 North Toryglen Green Infrastructure and Access Project, Building with Nature
[Toryglen detail — Building with Nature](#)

1.5 Whole Life Carbon: The Cross Tay Link Road: Reducing Embodied Carbon Through Construction Project Design
[Sustainable procurement duty - Public sector procurement - gov.scot \(www.gov.scot\)](#)

1.6 Designing Out Waste – constructing a circular economy, South Lanarkshire College Low Carbon Teaching Building Case Study
[Designing Out Construction Waste Guide 0.pdf \(zerowastescotland.org.uk\)](#)

1.7 Merkinch Primary School: A lesson in low carbon construction
[Construction Scotland | Industry Leadership Group | Merkinch Primary School: A lesson in low carbon construction \(cs-ic.org\)](#)

1.8 TECA: A tale about team work
[teca-clf.pdf \(cs-ic.org\)](#)

1.9 Net Zero Public Sector Building Standard Pathfinder Projects, Scottish Futures Trust
[overviewofstandardpathfinderprojectsv1.pdf \(scottishfuturestrust.org.uk\)](#)

1.10 Environmental security: Stirling Council, SEPA Sustainable Growth Agreement
[stirling_council_sga_booklet.pdf \(sepa.org.uk\)](#)

1.11 Sustainable travel: Stirling Council and Partners, Transformational active travel - Places for everyone
[Transformational active travel project soon to begin in Stirling - Sustrans Showcase \(showcase-sustrans.org.uk\)](#)

1.12 Inclusive growth: North Ayrshire Council, Community Wealth Building Strategy
[NAC CWB Strategy Brochure \(north-ayrshire.gov.uk\)](http://north-ayrshire.gov.uk)

1.13 Measuring social impact in public procurement, case studies
[Measuring social impact in public procurement: SPPN 10/2020 - gov.scot](http://www.gov.scot)
 [\(www.gov.scot\)](http://www.gov.scot)

SUSTAINABLE CONSTRUCTION MATRIX

12.1 The development of a sustainability matrix can help to summarise and communicate the various needs and requirements of a project during early stages. It can also provide clients with a tool that supports review and evaluation during the development stages of a project.

A example of a Sustainability Matrix is available in the [supported documents](#) section.